

~~2/~~
~~cancel~~

[bit rate] at said second bit rate.

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cancel

7. ^{10.} (amended) Apparatus according to Claim ^{8.} 5, wherein [the] said means [operable to detect encoder stage output bit rates specifies] for detecting a bit rate stores a plurality of contiguous ranges of bit rate values and [is configured], on first detecting an encoder output bit rate [value with a] falling ^{within} with a first [one] of [the] said ranges, [to maintain] maintains the derived second bit rate substantially constant until a detected encoder output bit rate falls within another of [the] said ranges [is detected].

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8. ^{5.} (amended) A method as claimed in Claim 1, wherein [An encoded digital video signal compressed by the method of claim 1, comprising a bit stream of encoded data for a sequence of video image frames, characterized in that] an instantaneous bit rate of [the signal] an image frame of the encoded digital video signal bit stream is inversely related to a bit density of an image frame of said bit stream n frame periods later, where n is determined by said bit density.

Claim 9, line 3, delete "the frame, or";
line 4, delete "," (comma);
line 5, change "the" to --a--.

REMARKS

The specification has been amended to effect minor clarifications of the idiomatic English and to eliminate the "umbrella" statement beginning at line 26 on page 14 which is not in conformity with U.S. practice.

Independent method claim 1 and independent apparatus claim 5 were rejected as anticipated by Lhuillier et al. Those claims have now been amended to more clearly set forth the patentable distinctions over that reference.

The Invention

The present invention is directed to the problem that bit compression as applied to transmission of successive frames of a video picture results in considerable variation in the bit rates of the video data stream, which affects the allocation of buffer capacity in both the encoder and the decoder. In order to maintain continuous display of the video picture a constant system delay must be maintained between the input to the encoder and the output from the decoder (see specification page 2, lines 24-27). However, in order to make effective use of buffer capacity a relatively low delay is provided for high signal bit rates and a relatively high delay is provided for low signal bit rates. Thus, the objectives of constant system delay and maximum utilization of buffer capacity appear to be incompatible.

The invention resolves this problem by providing a "tunable delay" resulting from different input and output bit rates in the encoder buffer, so as to enable the contents of the decoder buffer to remain relatively constant. The tunable delay introduces a higher delay at high input signal bit rates and a lower delay at low input signal bit rates, thus compensating to some extent for the delay variation produced by the buffering system as heretofore employed (see specification, page 3, lines 21-29). Such tunable delay is produced by appropriate control of the relation between the input and

output bit rates of the encoder buffer. In accordance with the invention, the output bit rate is a percentage of the input bit rate and such percentage is varied inversely in relation to variations in the input bit rate.

Art Rejection - Lhuillier

This reference is concerned with an entirely different problem; namely, variable-length encoding such that each frame is coded with a substantially constant number of bits but nevertheless a relatively large capacity buffer store can be employed. That is achieved by determining an average quality value q of each frame or packet, and correcting the actual number of bits in the packet in accordance with the number of bits corresponding to the average quality value (see Col. 1, lines 25-62). For a given packet, the ratio of the actual number of bits to the number of bits corresponding to the average quality is constant (Col. 1, lines 64-67).

Clearly, none of this has anything to do with making the most effective use of the encoder and decoder buffers in a system wherein a constant system delay is to be maintained, as in Applicant's invention.

The Examiner characterized equation (3) in Col. 4 of Lhuillier as disclosing derivation of a second bit rate which is inversely related to changes in a first bit rate. That equation indicates the relation between a corrected quality value and an actual quality value, which relation is a function of the accumulated differences between the actual number of bits n_i assigned to a block in a packet and the desired number of bits d_i for coding such block with an average quality which is assigned to the packet (see Col. 3, lines 31-33). Note that

the quality q is shown in inverse form on both sides of the equation, so that there is not really an inverse relationship. The inverse form is used because the product $n_i q^{-1}_i$ is a constant (Col. 3, lines 34-35).

It is apparent that all of this is far removed from the provisions in each of claims 1 and 5 in regard to reading a bit stream out of a buffer at a bit rate which is a percentage of the bit rate at which data is written into the buffer, and changing such percentage in inverse relation to changes in the write rate. Applicant therefore respectfully submits that there is no basis on which Lhuillier can be construed as teaching that feature of each of Applicant's claims 1 and 5. According, those claims as well as claim 2 dependent on claim 1 clearly patentably distinguish from that reference.

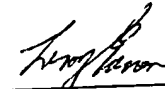
Art Rejection - Lhuillier in view of Reininger

Claims 3-4 and 6-9 were rejected as unpatentable over Lhuillier in view of Reininger, which relates to a VBR motion compensation predictive encoder. However, nowhere in Reininger is there any teaching to provide an inverse percentage relationship between changes in the write and read rates of an encoder buffer. Accordingly, the combination of Reininger with Lhuillier does not arrive at that feature of each of independent claims 1 and 5. Since claims 3, 4, 8 and 9 are dependent on claim 1, and claims 6-7 are dependent on claim 5, each of such dependent claims also include that feature and consequently distinguish from the cited references as do claims 1 and 5 as explained above.

Conclusion

For the above reasons, it is believed that this application is now in condition for allowance. Reconsideration and such action is earnestly solicited.

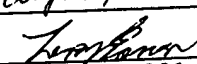
Respectfully submitted,

By 
Leroy Eason, Reg. 17,391
Consulting Patent Attorney
(914) 333-9632
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